

Infant Mortality in Rhode Island: A Time Trend Analysis

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The infant mortality rate is often seen as a global measure of child health. The rate of infant mortality in Rhode Island and the United States as a whole has decreased four-fold over the past 35 years. However, the rate of improvement in both areas has slowed over the past fifteen years, nearly leveling off in the past five.^{1,2} In order to better understand the reasons for the recent lack of improvements in infant mortality rates, it is important to consider age of death, birth weight, and other contributing factors, including prematurity and multiple gestation births.

Methods. Birth and death certificate data from Vital Records were analyzed for Rhode Island residents for the years 1987-2001. Rhode Island resident infant deaths (aged less than 365 days) were identified and linked to the corresponding birth records. Infant mortality rates (IMR) were computed as deaths per 1,000 live births. Rhode Island data for 1999-2001 are provisional. Infant mortality data for the United States was obtained from published sources.³

Prematurity data for both Rhode Island and the United States were obtained from the National Center for Health Statistics (NCHS) and the March of Dimes for the period 1990-1999.⁴ These data were used because Rhode Island's methodology for determining prematurity (i.e., gestational age assigned by physician) differs from that used by the NCHS (i.e., gestational age calculated using date of last menstrual period and infant's date of birth). To ensure comparability, the NCHS data as cited by the March of Dimes were used.

The Perinatal Periods of Risk (PPOR) approach developed by Dr. Brian McCarthy and the World Health Organization was modified for this analysis.⁵ The PPOR can be used by communities to monitor and investigate infant mortality and to identify gaps, target resources, and mobilize communities to action. The PPOR groups infant deaths by birth weight and

age of death. By determining the "periods of risk" and the proportion of deaths attributable within each, risk factors can then be associated with each period.

Although standard PPOR studies include fetal deaths with gestational ages greater than 24 weeks, fetal deaths were not included in this analysis due to small numbers and the large proportion with unknown gestational age or birth weight. Additionally, PPOR excludes deaths among infants with birth weights less than 500 grams. This analysis, however, includes all infant deaths. Data for three five-year periods, 1987-1991, 1992-1996 and 1997-2001, were analyzed.

Using PPOR guidelines, infant deaths were grouped by age of death (early neonatal, <7 days; late neonatal, 7-27 days; and postneonatal, 28-364 days) and birth weight (<1,000 grams, 1,000-1,499 grams, 1,500-2,499 grams, and 2,500 grams or greater). When birth weights were unknown, gestational age was used as an estimate for the period 1989-2001; gestational ages were not available for 1987 and 1988. Based on birth weight and age of death, infant deaths were grouped into three PPOR categories: maternal health, infant care and newborn care. (Table 1)

Table 1. Perinatal Periods of Risk: Definitions and Infant Mortality Rates, Rhode Island, 1987-2001

Perinatal Period of Risk (PPOR)	PPOR Definitions		Infant Deaths and Rates/1,000								
	Birth Weight (grams)	Age of Death	1987-1991			1992-1996			1997-2001		
			#Dths	Rate	%All	#Dths	Rate	%All	#Dths	Rate	%All
Maternal Health	≤1,499	Early Neonatal Late Neonatal Post Neonatal	315	4.3	50%	231	3.4	53%	258	4.1	63%
Newborn Care	1,500-2,499	Early Neonatal Late Neonatal	98	1.3	15%	74	1.1	17%	56	0.9	14%
	≥2,500	Early Neonatal									
Infant Care	1,500-2,499	Post Neonatal	168	2.3	27%	113	1.7	27%	91	1.5	23%
	≥2,500	Late Neonatal Post Neonatal									
All Deaths*	All	All	627	8.6	100%	434	6.4	100%	409	6.5	100%

* Note: Table does not include cases with missing data.

The PPOR model assigns very low birth weight deaths to "maternal health", other neonatal deaths to "newborn care", and late deaths to "infant care". These categories can then be used to focus attention on contributing factors (e.g., maternal health: preconceptional health, perinatal care, and health behaviors; newborn care: congenital anomalies, neonatal care, and pediatric surgery; and infant care: sleep position, breastfeeding, and injury prevention).

Results. Between 1965 and 1985, the IMR in Rhode Island dropped from 22.3 deaths per 1,000 live births to 8.2, (down 63%, or 4.9% per year on average). Similarly, during the same time period, the US rate decreased from 24.7 in

1965 to 10.6 (down 57%, or 4.1% per year). Over the past fifteen years, the IMR has fallen more slowly in both Rhode Island and the United States. Between 1986 and 2001, the IMR decreased by 30% in Rhode Island (2.4% per year) and 35% (2.8% per year) in the United States. During the past five years, 1997-2001, decreases in infant mortality have been small, 7% in Rhode Island (1.4% per year), and 6% in the United States (1.2% per year). (Figure 1)

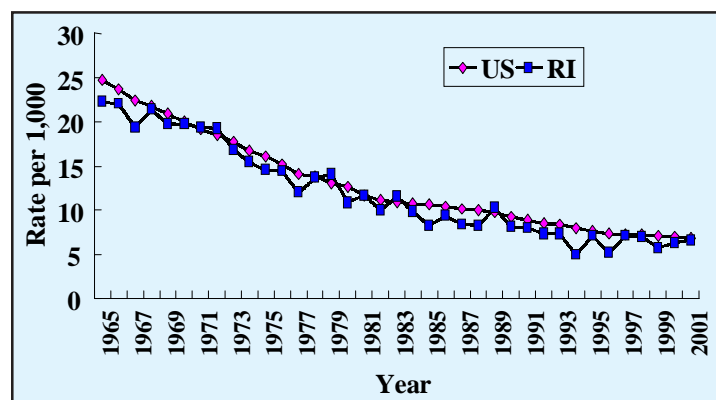


Figure 1. Infant Mortality Rates, United States and Rhode Island, 1965-2001.

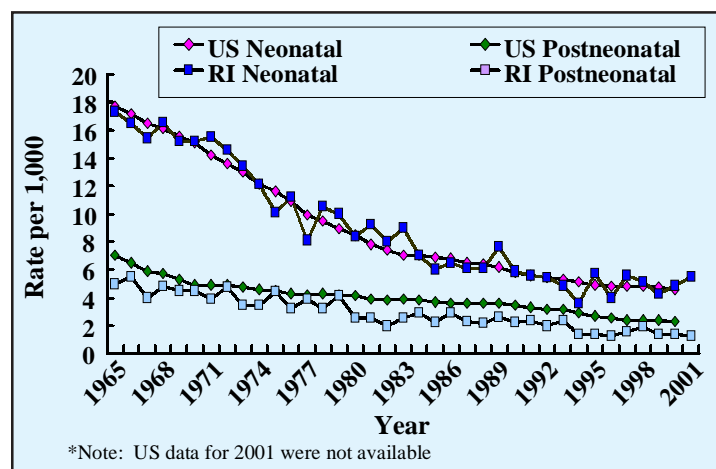


Figure 2. Neonatal and Postneonatal Mortality Rates, United States and Rhode Island, 1965-2001.

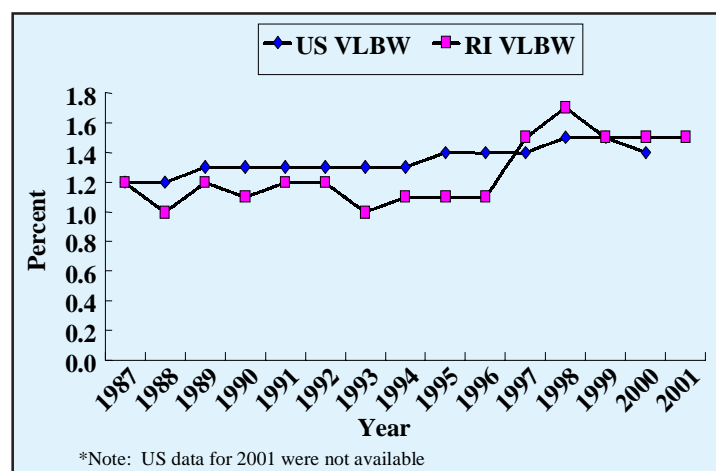


Figure 3. Very Low Birth Weight Births, United States and Rhode Island, 1987-2001.

Declines in neonatal (occurring under 28 days of age) and postneonatal (occurring between 28 and 365 days of age) mortality rates in Rhode Island have also mirrored the national trend. However, during 1965-2000, Rhode Island experienced a slightly sharper drop in postneonatal mortality (72%) than the nation (67%). (Figure 2)

A comparison of three five-year periods shows that the average IMR fell from 8.6 in 1987-1991 to 6.4 in 1992-1996, but remained static at 6.5 for the 1997-2001 period. (Table 1) During these three periods, the proportion of infant mortality among those with birth weights less than 500 grams increased. During 1987-1991, 22% of the infant deaths were among those with birth weights <500 grams and by the 1997-2001 period, the proportion rose to 35%.

Based on the Perinatal Periods of Risk (PPOR) approach, the proportion of infant mortality in Rhode Island attributed to maternal health was significantly greater during 1997-2001 than both the 1987-1991 and 1992-1996 periods. (Table 1) During 1997-2001, 63% of the total infant mortality was attributable to maternal health compared with 50% and 53% for 1987-1991 and 1992-1996, respectively. The proportion of infant mortality that was attributable to newborn care and infant care was nearly the same for all three time periods, ranging from 14% to 17% for newborn care and 23% to 27% for infant care.

During the 1987-2001 period, the percentage of Rhode Island babies born at low birth weight (less than 2,500 grams) rose by 22%, from 6.0% to 7.3%. Similarly, the percentage of very low birth weight (less than 1,500 grams) babies rose by 25%, from 1.2% to 1.5%. (Figure 3) Although the number of Rhode Island babies born annually at extremely low birth weight (<500 grams) is small, the number has increased by 65%, from 20 in 1987 to 33 in 2001. At the national level, smaller increases were seen in low birth weight (10%) and very low birth weight (15%) births over the period 1987-2000.

The percentage of babies born prematurely (less than 37 weeks gestation) has also been rising steadily in both the United States and Rhode Island. Between 1990 and 1999, the percentage of premature births in the United States rose from 10.6% to 11.8%. (Figure 4) During the same period in Rhode Island, the rate of prematurity rose more sharply from 9.6% to 11.3%.

During the past fifteen years, the proportion of births that are multiple gestations (twins, triplets, and higher order births) has risen in the United States and Rhode Island. (Figure 5) Nationally, the rate of multiple births rose from 22.0 per 1,000 in 1987 to 31.1 in 2000, a 41% increase. In Rhode Island, the rise in multiple births was significantly greater (71%), increasing from 21.8 in 1987 to 37.2 in 2001.

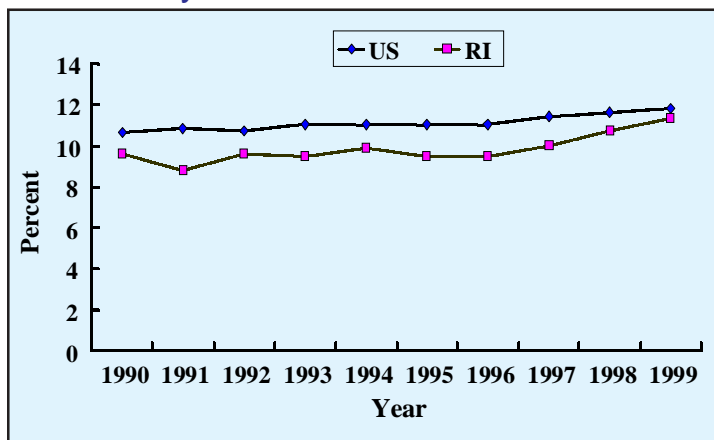


Figure 4. Premature Births, United States and Rhode Island, 1990-1999.

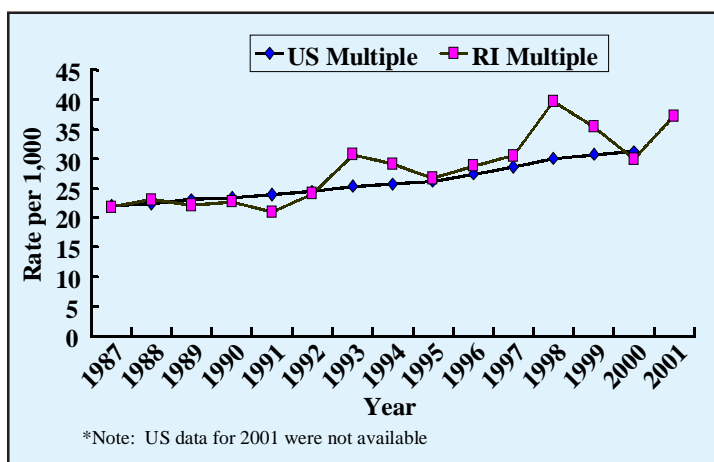


Figure 5. Multiple Births, United States and Rhode Island, 1987-2001.

Discussion. The proportion of infant mortality in Rhode Island that is attributable to maternal health factors has increased in the past fifteen years. Factors contributing to this increase include an increase in the number of very low birth weight (<1,500 grams) infants; an overall increase in prematurity; and an increase in multiple gestation births. The

growth of multiple gestation births has also contributed to the increase in premature and low birth weight births.⁶

The lack of improvement in infant mortality has occurred while smoking rates among pregnant women have been declining and rates of early entry into prenatal care, including fertility treatment, have been improving in the United States and Rhode Island. Addressing maternal health issues such as, preconceptional health, health behaviors (e.g., tobacco use, drug abuse, etc.), and perinatal care, including fertility treatment, may prevent deaths due to prematurity and very low birth weight. In addition, other factors such as stress, poverty, and nutrition, along with other elements of primary prevention, must be addressed.

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